

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY



(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 18 OCT 2005

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Applicant's or agent's file reference G69232 VA.be	FOR FURTHER ACTION See Form PCT/PEA/416	
International application No. PCT/EP2004/006374	International filing date (day/month/year) 14.06.2004	Priority date (day/month/year) 24.06.2003
International Patent Classification (IPC) or national classification and IPC F02B53/00, F01C1/344, F01C19/02, F01C21/10		
Applicant PONTIGGIA, Alessandro		
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 5 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 5 sheets, as follows: <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (Indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).		
4. This report contains indications relating to the following items: <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application		
Date of submission of the demand 20.04.2005	Date of completion of this report 19.10.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Paquay, J Telephone No. +31 70 340-3944 	

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/006374

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1, 3-8

as originally filed

2, 2a

received on 20.04.2005 with letter of 19.04.2005

Claims, Numbers

1-15

received on 20.04.2005 with letter of 19.04.2005

Drawings, Sheets

1/8-8/8

as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/006374

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-15
	No: Claims	
Inventive step (IS)	Yes: Claims	1-15
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-15
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

D1: DE 197 44 812 A (HEROLD & SEMMLER TRANSPORTTECH) 8 April 1999
(1999-04-08)

Document D1 discloses (*the references in parentheses applying to this document*) a rotary engine (*figure 1*) comprising two components, namely a stator (1) and a rotor (2) torsionally rigid with an output shaft ("*Wellenzapfen*", *column 4, line 10*), where of said stator (1) and said rotor (2) a first component (1) presenting a chamber the surface of which presents circular symmetry about an axis of said first component and a second component (2) being formed from a body (2) which is disposed in the interior of said chamber and of which the envelope presents circular symmetry about an axis of said second component, said envelope being similar to said chamber, said axes being fixed, mutually parallel and non-aligned, one of said components rotating about its axis, the first component being a stator (1) and the second component being a rotor (2) having a body (2) torsionally rigid with the output shaft (*because of column 4, line 10*), the axis (*the cross point of the upper horizontal and the vertical centre line in figure 1*) about which the envelope presents circular symmetry being a rotor axis of rotation (*the cross point of the upper horizontal and the vertical centre line in figure 1*), said axis (*the cross point of the upper horizontal and the vertical centre line in figure 1*) being eccentric to the stator axis (*the cross point of the lower horizontal and the vertical centre line in figure 1*), the body (2) presenting surface recesses (*for the seals 4*) acting as guides for seal means (4) which slide along the surface of the chamber as the body (2) rotates, and which together with the surface of the body (2) and of the chamber define sealed chambers, said chambers "sliding" relative to the surface of the stator chamber (1) as the output shaft rotates.

The difference between the subject-matter of claim 1 and the contents of document D1 is, that the seal means in the subject-matter of the first claim are split rings.

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(SEPARATE SHEET)**

International application No.

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The seal means in document D1 are made of relatively simple sealing blades. Document D1 hardly gives any details concerning the geometry of body 2. A man skilled in the art will not come to the idea of changing the seal means 4 in document D1 by split rings. The reason therefore is that for implementing split rings, the body (2) should have a spherical or similar to spherical shape. Document D1 does not give enough details concerning such a geometry of body 2. On top of that, split rings require a study of the intake and exhaust ports geometry. In view of all this, the subject-matter of claim 1 is considered as being inventive in the sense of article 33(3) PCT.

with the stator. A problem of the Wankel power unit is the radial seal of the stator-rotor system, which is obtained by U-shaped vanes mounted in suitable grooves parallel to the drive axis, and which are considerably stressed because the kinematics of the rotor movement and the particular shape of the stator.

5 Moreover the Wankel engine involves fairly complex kinematics and is not easy to construct and maintain.

Both in the reciprocating engine and in the Wankel engine the fuel-air mixture is compressed at each cycle; in the former the compression stage directly follows the intake stage. In the latter the intake stage is also followed by the
10 compression stage, compression being determined by the orbital movement which the rotor undergoes relative to the stator. The compression ratio is predetermined both for the former and for the latter engine, and cannot be varied other than by mechanical adjustments to the dimensions of the moving members, such as the connecting rod or the crank in the former case or the
15 dimension of the gearing on the output shaft or on the rotor in the latter. In particular, the compression ratio can be increased in both types of engine for example by suitable compressors, possibly of radial turbine type, to increase the pressure of the intake gas, however it cannot be decreased.

Furthermore DE 19744812 discloses a rotary engine comprising two
20 components, a stator and a cylindrical rotor torsionally rigid with an output shaft, the stator presenting a chamber the surface of which presents a cylindrical symmetry about its stator axis, and a rotor disposed in the interior of this chamber, and whose envelope presents circular symmetry about an axis parallel but not aligned to the stator axis, the rotor presenting recesses acting
25 as guides for stretched seal means.

Furthermore DE 4422720 describes a rotary engine similar to the one described in DE 19744812, but where the stator chamber surface presents an

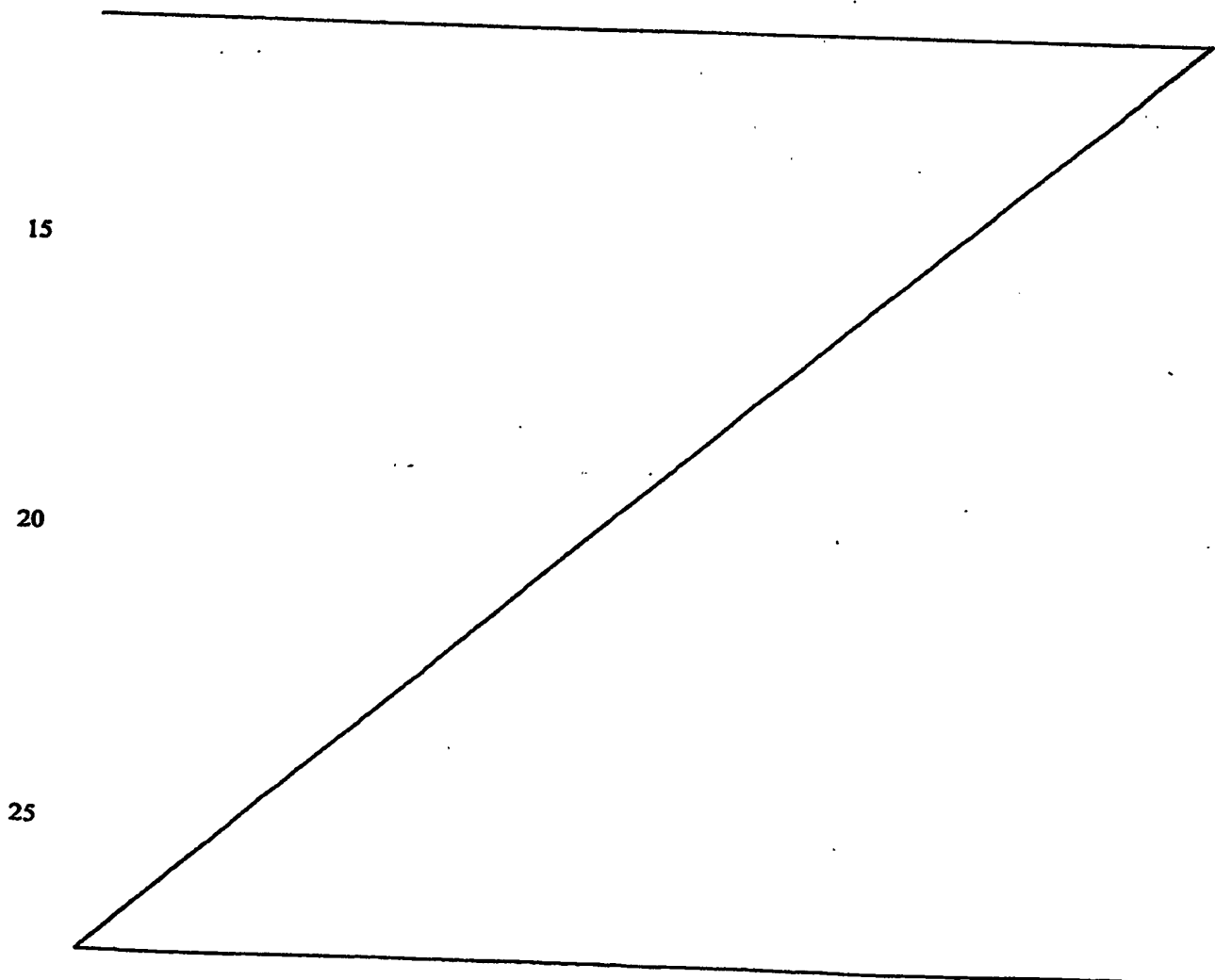
2a

elliptical section.

The technical aim of the present invention is therefore to provide a rotary engine by which the stated technical drawbacks of the known art are eliminated, including vibration.

- 5 Within the scope of this technical aim, an object of the invention is to provide a rotary engine without dead centres, which is simple and economical, and of small dimensions and low weight compared with conventional internal combustion engines.

Another object of the present invention is to provide a rotary engine which
10 enables the engine compression ratio to be chosen by simply varying the



CLAIMS

1. A rotary engine comprising two components, namely a stator (2), and a rotor (5) torsionally rigid with an output shaft (6), of said stator (2) and said rotor (5), a first component (2) presenting a chamber (3) the surface of which presents circular symmetry about an axis (10a) of said first component (2), and a second component (5) being formed from a body (7) which is disposed in the interior of said chamber (3), and of which the envelope presents circular symmetry about an axis (9) of said second component (5), said envelope being similar to said chamber (3), said axes (9, 10a) being fixed, mutually parallel and non-aligned, one of said components rotating about its axis (9), the first component being a stator (2) and the second component being a rotor (5) having a body (7) torsionally rigid with the output shaft (6), the axis (9) about which the envelope presents circular symmetry being a rotor axis of rotation (9), said axis (9) being eccentric to the stator axis (10a), the body (7) presenting surface recesses (8a, b) acting as guides for seal means (11a, b) which slide along the surface of the chamber (3) as the body (7) rotates, and which together with the surface of the body (7) and of the chamber (3) define sealed chambers (A, B, C, D), said chambers "sliding" relative to the surface of the stator chamber (3) as the output shaft (6) rotates; characterised in that the seal means (11a, b) are split rings.
2. An engine as claimed in claim 1, characterised in that the stator (2) presents a cylindrical cavity (4) for housing the output shaft (6).
3. An engine as claimed in claim 2, characterised in that seal means (12) are present between the cylindrical cavity (4) housing the output shaft (6) and the body (7).
4. An engine as claimed in claim 1, characterised in that the chamber (3) present in the stator (2) is substantially spherical with its centre (10) lying on the

axis (10a), or is ellipsoidal or cylindrical.

5. An engine as claimed in claim 1, characterised in that the body (7) has a substantially spherical, ellipsoidal or cylindrical envelope, and has circular symmetry.

5 6. An engine as claimed in claim 5, characterised in that the surface recesses (8a, b) are disposed at 90° apart in the direction of the axis of rotation (9).

7. An engine as claimed in claim 1, characterised in that ports (20a, 21a, b, 22, 23a, b, c, d, e, f, 26, 270) are present in the surface of the chamber (3).

10 8. An engine as claimed in one or more of the preceding claims, characterised in that the seal means (11a, b) comprise rigid rings (110) and elastic sealing parts (111, 112).

9. An engine as claimed in claim 7, characterised in that the seal means (11a, b) present sliding ends of different shape and materials.

15 10. An engine as claimed in one or more of the preceding claims, characterised in that the seal means (11a, b) urged by elastic means (45), to improve the seal against the surface of the chamber (3).

11. An engine as claimed in one or more of the preceding claims, characterised in that the rigid rings (110) present means (120) for discharging
20 the centrifugal force acting on them.

12. An engine as claimed in one or more of the preceding claims, characterised in that the seal means (11a, b) present further seal means (140) to ensure sealing against the walls of the surface recesses (8a, b).

13. An engine as claimed in one or more of the preceding claims,
25 characterised in that the body (7) presents surface notches (40), recesses (41), protuberances (42), or slots 44 to improve engine efficiency.

14. An engine as claimed in claim 7, characterised in that at least one port

(20a, 21a, b, 22, 23a, b, c, d, e, f, 26, 270) is provided with valve means (27).

15. A method for operating an engine claimed in one or more of the preceding claims, characterised in that:

- with the output shaft (6) rotating, compressed air is injected via a first feed port
s (21a) while fuel is injected via a second feed port (21b), or an air/fuel mixture is injected via only the port (21a);
- an ignition means, present in the port (22), thus ignites the contents of the chamber A;
- the mixture expands to create within the chamber A a pressure, the resultant
10 of which is a force which when transferred to the body (7) creates a variable drive torque on the output shaft (6);
- the exhaust gas mixture is discharged when the chamber A, dragged by the rotation of the shaft, communicates with an exhaust port (23a) and continues to discharge via subsequent ports (23b, c, d, e, f).